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No. 3 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 22 May 1974

**Organizational DS, GS, and Depot
Maintenance Manual Including Repair Parts and Special Tools List**

**OSCILLOSCOPES AN/USM-140B, AN/USM-140C,
AN/USM-141A AND AN/USM-141B**

TM 11-6625-535-15-1, 5 May 1966, is changed as follows:

1. A vertical bar appears opposite changed material.
2. Remove and insert pages as indicated in the page list below:

Remove

iii through iv.1
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3. File this change sheet in front of the publication for reference purposes.

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NG: None.

USAR: None.

For explanation of abbreviations used, see AR 310-50.

FRONT MATTER

UNCLASSIFIED
NAVSHIPS 95706

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SECTION A

INTRODUCTION

A-1. Indexes of Publications

a. *DA Pam 310-4*. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. *DA Pam 310-7*. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

A-2. Forms and Records

a. *Reports of Maintenance and Unsatisfactory Equipment*. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. *Report of Packaging and Handling Deficiencies*. Fill out and forward DD Form 6 (Report of Packaging and Handling Deficiencies)

as prescribed in AR 700-58/NAVSUP PUB 378/AFR 71-4/MCO P4030.29, and DSAR 4145.8.

c. *Discrepancy in Shipment Report (DISREP) (SF 361)*. Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33/AFM 75-18/MCO P4610.19A, and DSAR 4500.15.

A-3. Reporting of Errors

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publication and Blank Forms) and forwarded direct to Commander, US Army Electronics Command, ATTN: AMSEL-MA-C, Fort Monmouth, NJ 07703.

AN/USM-140B
GENERAL DESCRIPTIONUNCLASSIFIED
NAVSHIPS 0967-133-7010SECTION I
GENERAL DESCRIPTION

1-1. SCOPE

NAVSHIPS 95706 is a single-volume technical manual that includes operating and servicing instructions and a list of replaceable parts prepared in accordance with MIL-M-15071 E (SHIPS) for Oscilloscopes AN/USM-140B, AN/USM-140C, AN/USM-141A, and AN/USM-141B. The electrical specifications, operating and servicing instructions, schematic diagrams and parts list are identical for all models with noted exceptions. The AN/USM-140B and AN/USM-140C are portable models for bench-top use; the AN/USM-141A and AN/USM-141B are designed for permanent installation in a standard 19-inch wide rack. No other publications are required or supplied for these oscilloscopes at the date of this publication. Subsequent references to the Oscilloscopes in this manual will list only the cabinet model AN/USM-140B except to indicate minor differences in details.

1-1.1. Items Comprising an Operable Equipment

FSN	Qty	Nomenclature
6625-987-6603		Oscilloscope AN/USM-140B consisting of:
6625-400-2681	1	Oscilloscope OS-121B/USM-140
	1	Preamplifier, Dual Trace MX-2930B/USM (Plugged into OA-121/USM-140)
6625-961-5888	1	Auxiliary Plug-In MX-3078/USM (Plugged into OS-121/USM-140)
6625-973-4775	2	Prod, Test MX-4073/U (Mounted in equipment)
5935-823-0639	2	Connector, Adapter UG-255A/U (Mounted in equipment)
5935-149-3534		Connector, Adapter UG-273/U (Mounted in equipment)

FSN	Qty	Nomenclature
5995-985-7744		Cable Assembly, Power, Electrical CX-4704/U (8 ft 0 in.) (Mounted in equipment)
5995-752-8781	2	Cord CG-409F/U (Mounted in equipment)
5935-683-7892	2	Connector, Adapter: MIL type MS35173-274B (Mounted in equipment)
4935-992-6112	4	Adapter, Connector UG-1441/U

1-2. General Description

The AN/USM-140B is a precision high-speed oscilloscope for displaying the waveforms of electrical voltages at frequencies ranging from direct current to 22 megacycles (equivalent to a risetime of 16 nanoseconds). Vertical deflection sensitivity is continuously adjustable from 200 volts to 20 millivolts per centimeter; horizontal deflection sensitivity is continuously adjustable from 100 volts to 0.1 volt per centimeter at frequencies from direct current to 1 megacycle per second. Sweep rates are continuously adjustable from 15 seconds to 0.1 microsecond per centimeter. The sweep can be synchronized with an external signal or with the signal being viewed. Polarity and sensitivity of the synchronization are selectable to permit synchronization from different voltage points on complex waveforms. The AN/USM-140B is especially developed for general-purpose use in US Navy ship and shore electronic maintenance and research facilities. It is designed for versatility, and reliability under a wide range of environmental conditions, combined with wide frequency range, accurate calibration, and stable synchronization at high sweep rates. Sweep rate, sweep expansion and sensitivity controls are direct-reading. Each calibrated step-type control is equipped with a potentiometer to give

continuous adjustment between steps. Special features include: a beamfinder pushbutton to simplify the problem of finding and centering off-screen traces; a front-panel calibrator that provides squarewave voltages from 0.2 millivolt to 100 volts for checking the accuracy of the vertical and horizontal sensitivity selectors; an internal 200-nanosecond vertical signal delay to permit viewing the leading edge of the signal that triggers the sweep; sweep and gating output signals for use in external equipment. Typical uses for the oscilloscope include precise waveform analysis and oscillography used in the research, design and service of electronic circuits, waveform observations required for adjusting operating equipment such as radio transmitters, and precise measurements of time and frequency.

1-3. Description of Units

The AN/USM-140B consists of a major oscilloscope unit, two plug-in units which install in recesses in the front panel of the major unit, and a group of accessory cables and connectors stored in the detachable front cover.

a. OSCILLOSCOPE OS-121B/USM-140.—The major unit, Oscilloscope OS-121B/USM-140, contains the power supplies, horizontal amplifier, sweep generator, main vertical amplifier, cathode ray tube, calibrator and the controls associated with these circuits.

b. OSCILLOSCOPE SUBASSEMBLY, VERTICAL CHANNEL, DUAL TRACE PREAMPLIFIER.—This plug-in unit, MX-2930B/USM, permits simultaneous observation of two separate vertical input signals, each signal being controlled and positioned independently. This unit provides three methods of observing the two input signals, 1) each input signal on alternate sweeps, 2) each input signal on alternate 1-microsecond segments of the two input waveforms, 3) the difference voltage of the two input signals combined. Either channel can be also selected for single-channel operation.

c. OSCILLOSCOPE SUBASSEMBLY, HORIZONTAL CHANNEL, AUXILIARY PLUG-

IN UNIT.—This plug-in unit, MX-3078/USM, is required for normal repetitive sweeps and provides for single-sweep operation with either manual or external arming of the sweep, and also permits intensity modulation of the trace by external signals.

1-4. Reference Data

The AN/USM-140B is designed for continuous usage in ambient temperatures from -28°C to $+50^{\circ}\text{C}$ with relative humidity up to 99%. Within this range, the equipment will operate with the performance and accuracy specified below.

a. EACH VERTICAL CHANNEL.—

(1) Sensitivity Range (both AC and DC coupling): Ten calibrated ranges in 1-2-5-10 sequence from 0.02 volt/cm to 20 volts/cm; accuracy ± 5 percent. Vernier control extends sensitivity to 50 volts/cm.

(2) Frequency Pass Band:

DC coupled: dc to 22 mc (down 3 db points at 22 mc), 0.016 μsec rise time;

AC coupled: 2 cps to 22 mc between 3 db points (0.016 μsec rise time).

(3) Input Impedance: 1 megohm $\pm 10\%$ shunted by 30 pf on all ranges. 10 megohms shunted by 10 pf when using Test Prod MX-2817/U.

(4) Display Polarity: Selectable, + up or - up.

(5) Electronic Switching: Dual channel display by alternate sweep, or chopped at approximately 1 mc with trace blanking during switching.

b. DIFFERENTIAL INPUT.—

(1) Both input attenuators may be switched to one channel to give differential input. The input attenuators may be set separately to equalize input signals of different levels.

(2) Common Mode Rejection: At least 40 db at maximum sensitivity; at least 30 db when using attenuators.

c. SWEEP AND SYNCHRONIZATION.—

(1) Internal Sweep: 24 calibrated ranges

in 1-2-5-10 sequence from 0.1 $\mu\text{sec}/\text{cm}$ to 5 sec/cm , accuracy ± 3 percent. Vernier control extends slowest sweep to 15 sec/cm .

(2) Sweep Expansion: 7 calibrated ranges, in 1-2-5-10 sequence up to X100. Increases fastest sweep speed to 0.02 $\mu\text{sec}/\text{cm}$. Accuracy: X1, X2, and X5 ranges $\pm 3\%$; X10 and X20: $\pm 5\%$; X50 and X100: $\pm 10\%$ to 0.02 $\mu\text{sec}/\text{cm}$.

(3) Trigger Modes:

From external signals 0.5 volt peak-to-peak or greater;

from internal signals having 0.5 cm vertical deflection or greater;

from internal source of line frequency.

(4) Trigger Level and Slope: Uses positive or negative-going voltage, with trigger point continuously adjustable from -30 to +30 volts on external signals or any visible point on the waveform of internal signals.

(5) External Trigger Input Impedance: 1 megohm $\pm 10\%$ shunted by 70 pf.

(6) Sweep Output: -50 to +50 volts (approx).

(7) Gate Output: +50 volts (approx); length equal to duration of sweep.

d. HORIZONTAL AMPLIFIER.—

(1) Bandwidth:

DC coupled: dc to 1 mc (down 3 db at 1 mc);

AC coupled: 2 cps to 1 mc between 3 db points.

(2) Sensitivity: 7 calibrated ranges, in 1-2-5-10 sequence from 0.1 volt/cm to 10 volts/cm. Vernier control extends sensitivity to 25 volts/cm.

(3) Input Impedance: 1 megohm $\pm 10\%$ shunted by 30 pf.

e. CALIBRATOR.—

(1) Voltage: 9 calibrated ranges in 1-2-5-10 sequence, from 0.2 millivolts to 100 volts peak-to-peak; accurate to within $\pm 3\%$.

(2) Waveform: 1000-cycle square wave, 1- μsec rise and decay time.

(3) Current: 5 milliamperes peak-to-peak, $\pm 3\%$.

(4) Loading: 1 megohm or greater.

f. CATHODE RAY TUBE.—P2 phosphor with compatible green filter. (P31 phosphor may also be used).

(1) Graticule: 10 cm long by 4 cm high graduated in centimeter squares with 2 mm subdivisions on horizontal and vertical axes. Adjustable, edge lighting.

(2) Deflection Plate Connection: Pin type terminals.

(3) Deflection Sensitivity:

Vertical: approximately 20 volts/cm.

Horizontal: approximately 35 volts/cm.

(4) Intensity Modulation: + 20 volt pulse blanks CRT trace of normal intensity.

g. POWER REQUIREMENTS: 115 vac, $\pm 10\%$; 50~ $\pm 10\%$, 60~ $\pm 10\%$, and 400~ $\pm 10\%$; single phase, approximately 480 watts.

h. DIMENSIONS: See figures 2-2 and 2-3.

1-5. Equipment Supplied

The equipment supplied under AN/USM-140B is listed in table 1-1. In addition to the basic oscilloscope and its two plug-in units, two test prods, two coaxial cables and an assortment of connector adapters are provided to facilitate connecting the oscilloscope to a variety of equipments and circuits. Test Prods MX-2817/U (MX-4037/U may also be used) are specially designed broad-band probes equipped with alligator jaws for easy attachment to most forms of electrical conductors. Each test prod contains a compensated voltage divider that gives a 10-times increase in the input resistance of the oscilloscope channel with which it is used (vertical or horizontal input), with a reduced input capacity of 10 picofarads; use of the prod attenuates the input signal and reduces the height of the displayed waveform by a factor of 10.

Two BNC "TEE" adaptors are provided to facilitate connecting the same input signal to

two different input connectors. Four BNC-to-Binding Post adapters are supplied to permit connecting plain wire leads to the type BNC connectors on the oscilloscope. Two UHF-to-BNC adapters are supplied to permit connection to equipments using UHF connectors. Two eight-foot coaxial cables terminated in BNC

connectors are provided for connection to external equipments.

1-6. Equipment and Publications Required but not Supplied

A list of all equipments and publications required but not supplied is provided in table 1-2.

APPENDIX II

BASIC ISSUE ITEMS LIST (BIIL) AND ITEMS TROOP INSTALLED OR AUTHORIZED LIST (ITIAL)

Section I. INTRODUCTION

A2-1. Scope

This appendix lists only basic issue items required by the crew/operator for installation, operation, and maintenance of Oscilloscope AN/USM-140B.

A2-2. General

This Basic Issue Items and Items Troop Installed or Authorized List is divided into the following sections:

a. Basic Issue Items List—Section II. A list, in alphabetical sequence, of items which are furnished with, and which must be turned in with the end item.

b. Items Troop Installed or Authorized List—Section III. Not applicable.

A2-3. Explanation of Columns

The following provides an explanation of columns found in the tabular listings:

a. Illustration. Not applicable.

b. Federal Stock Number. Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Part Number. Indicates the primary num-

ber used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements, to identify an item or range of items.

d. Federal Supply Code for Manufacturer (FSCM). The FSCM is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., and is identified in SB 708-42.

e. Description. Indicates the Federal item name and a minimum description required to identify the item.

f. Unit of Measure (U/M). Indicates the standard of basic quantity of the listed item as used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation, (e.g., ea, in., pr, etc.). When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

g. Quantity Furnished with Equipment (Basic Issue Items Only). Indicates the quantity of the basic issue item furnished with the equipment.

Section II. BASIC ISSUE ITEMS LIST

(1) Illustration		(2)	(3)	(4)	(5)	(6)	(7)
(A) Fig. No.	(B) Item No.	Federal stock number	Part number	FSCM	Description Usable on code	Unit of meas	Qty furn with equip
		6625-071-0789			COVER, OSCILLOSCOPE CW-511/USM	EA	1

